Use of MultiCenter Traffic Management Advisor (McTMA) to Enhance National Airspace System (NAS)Security

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Agenda

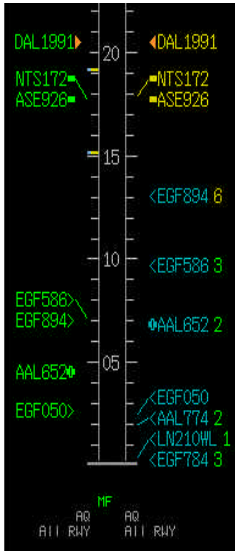
- Problem Statement
- McTMA Background
- McTMA as a Platform for Security Enhancements
- Extension of McTMA for NAS Security
- Draft Requirements for Security Enhancements
- Threat Assessment
- Architecture

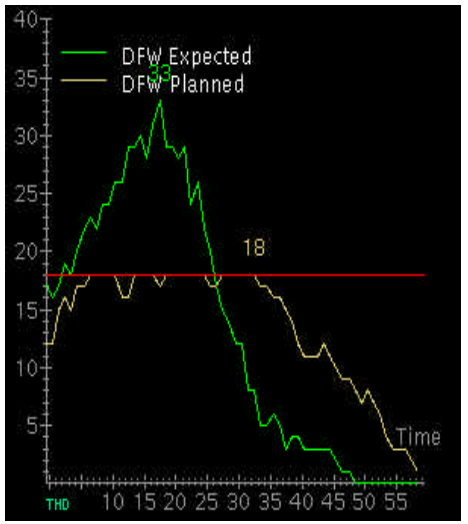
Problem Statement

- **Augment Air Traffic automation and processes to:**
  - **Detect and display to appropriate FAA and NORAD operational positions IFR aircraft which have anomalous deviations from approved flight plan**
  - **Minimize "false alarms" for anomalous deviations, while detecting anomalous behavior**
  - **Establish an "Operations Architecture" which provides electronically coordinated situational awareness information, including potential rogues and the response to such rogues, between FAA and NORAD**
  - **Provide avoidance maneuver recommendations for aircraft threatened by rogue or high-threat aircraft**
  - **Provide alert information for potential ground "targets" threatened by rogue or high-threat aircraft**
  - **Ensure that air defense aircraft transition safely through the traffic environment to accomplish their mission**
  - **If necessary, facilitate the shutdown of portions or all of the NAS**

Traffic Management Advisor (TMA)

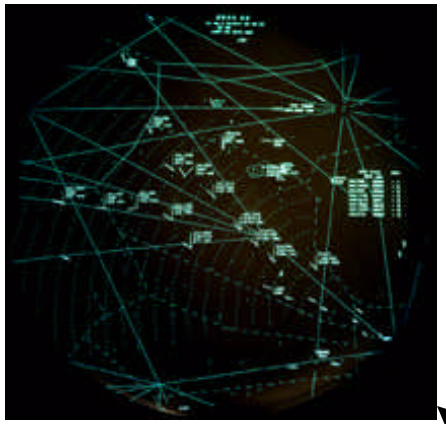
- Traffic Management tool to provide arrival traffic flow visualization and scheduling
- Assists controllers in balancing arrival demand with airport capacity while minimizing delays





- Develops a safe and efficient schedule for arrival traffic to maximize airport capacity
- Increases airport capacity, reduces arrival delays, and reduces controller workload by advising enroute sector controllers of the *optimized* schedule

TMA Simplified System Description



Controller advisories

Flight plan data
Radar Track & Speed
Controller commands

Atmospheric data

System control & communication

TMC Flow Visualization

Arrival time prediction

Constraint Scheduling

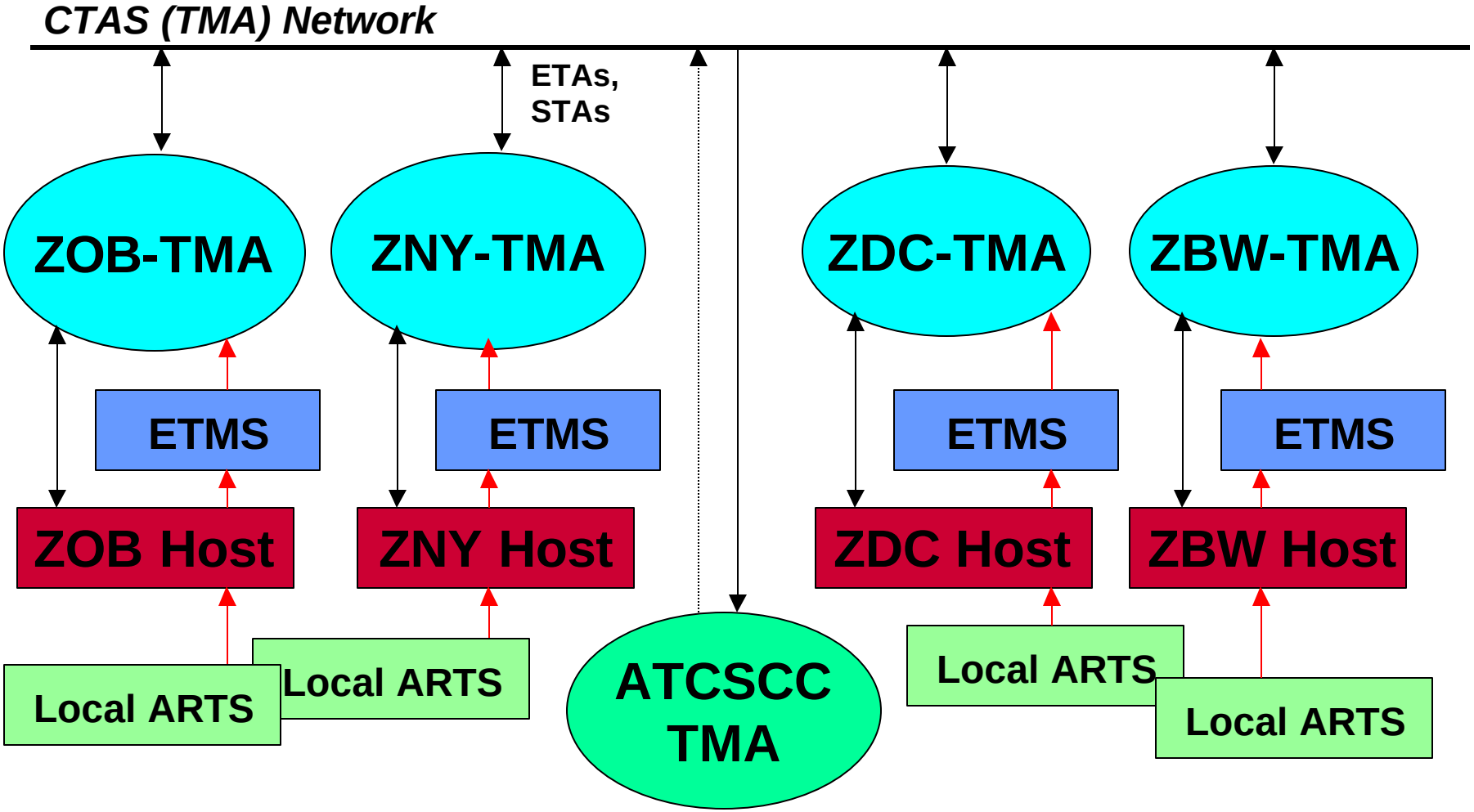
Operational ATC Computer

TMA Workstations

What is McTMA?

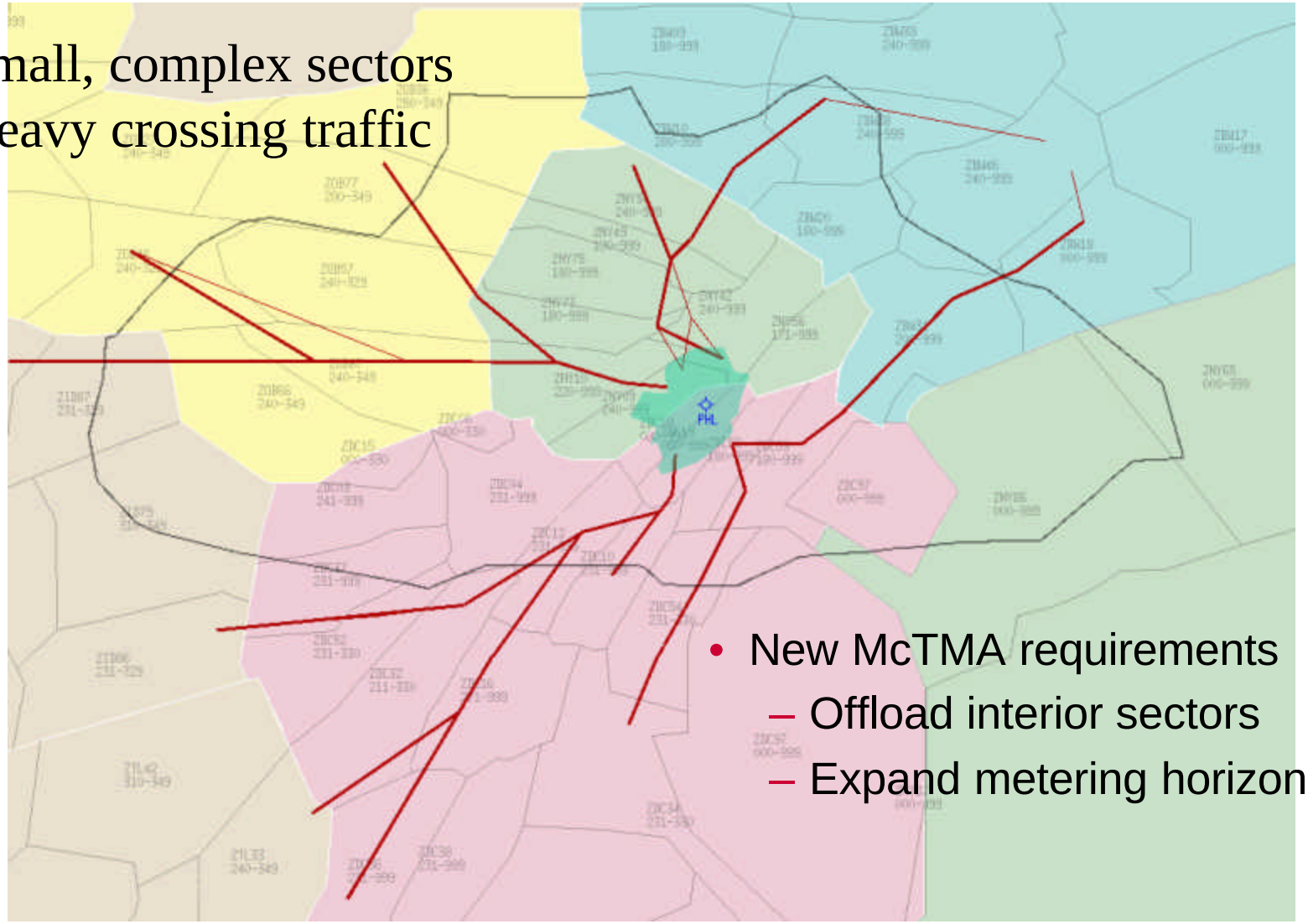
- McTMA is an extension of the TMA Single-Center to regions where more than one facility is significantly involved in arrival traffic flow management
  - Incorporates system requirements and operational procedures for re-planning across multiple facilities
  - Enables transition to time-based metering
  - Scheduling information for airports and boundaries
  - Facilitates regional collaboration
  - Identifies and aids in alleviation of airspace resource congestion problems
- McTMA is a priority research project for FFP2, with a goal of providing capability in the field in the 2003-2005 timeframe.

McTMA System Architecture



Philadelphia Arrival Sectors

Small, complex sectors
Heavy crossing traffic



- New McTMA requirements
  - Offload interior sectors
  - Expand metering horizon

McTMA as a Platform for NAS Security Enhancements

- Data availability from each FAA Center and from major TRACONS
  - Most accurate and most frequent source of En Route track data
  - Track position and velocity, aircraft id, flight plans, and beacon code all available for each track
- Platform has rich set of capabilities for security enhancements
  - Architecture already supports most NAS Security features
  - Many features already present, or need only minor updates
- Already projected for deployment

Extension of McTMA for NAS Security (end state)

- FP Anomaly Detection – filter out benign and low-threats
- Added detection of threatened a/c and threatened "targets"
- Monitoring capability for Local, Central, and DoD
  - Filterable "See-All" and/or detailed look at one Center
  - Electronic query messages between local monitor and Controller and among local and central/DoD monitors
- Count-down timers to threatened high-priority ground "targets"
- Conflict Resolution capability to help clear airspace in vicinity of rogue

Draft System Requirements

- High-level, built on top of McTMA requirements
- Postulated based on operational experience
- Need input from others in community
  - FAA
  - NORAD
  - JTAMDO
  - Homeland Defense
  - TSA
  - FBI
  - Others?

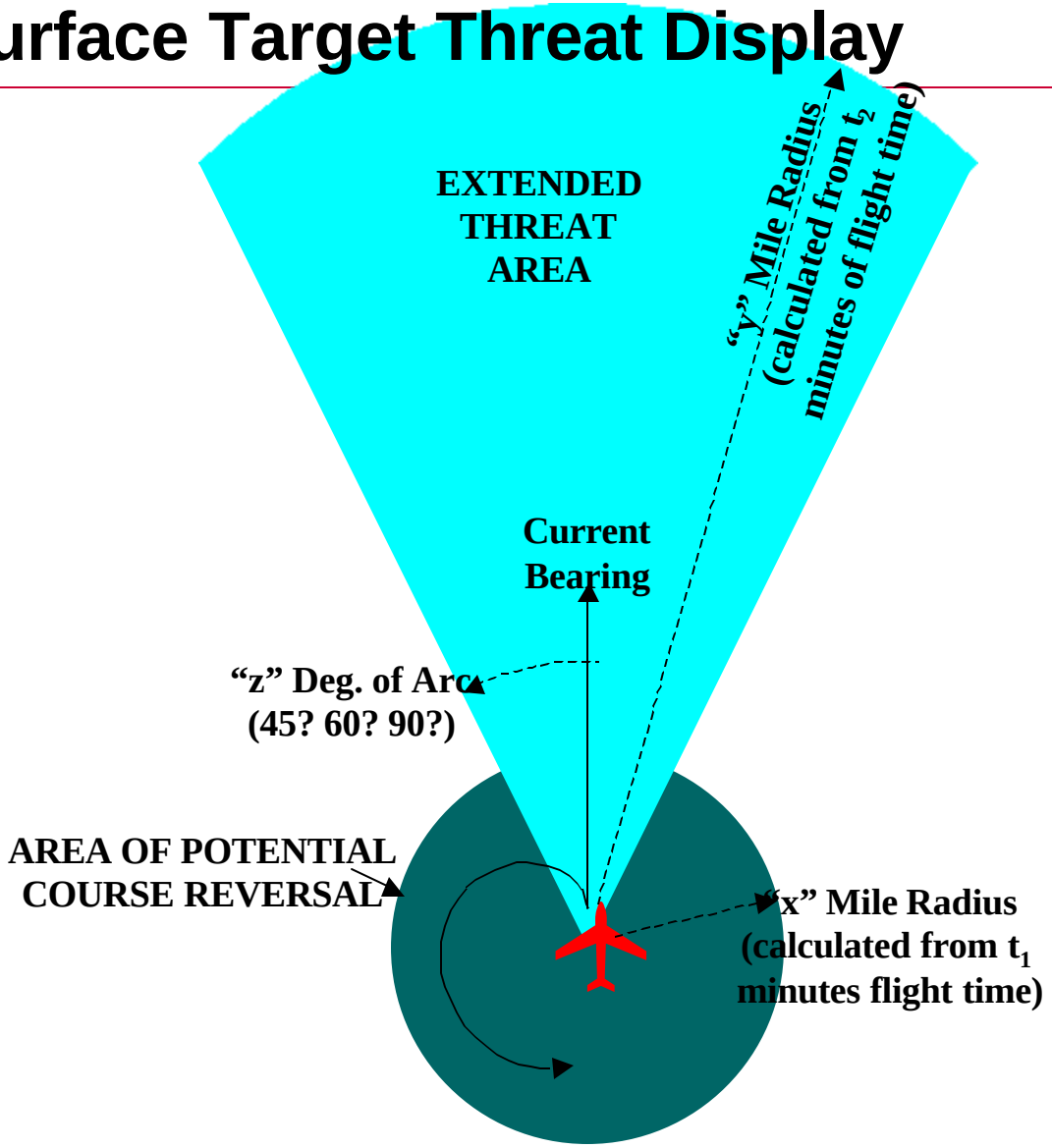
Draft System Requirements (cont'd)

- **Flight Plan Anomaly Detection**
  - **The System shall detect when aircraft have deviated from their flight plans**
  - **The System shall filter and prioritize (into high, medium, and low) the potential risks associated with these deviations based on:**
    - **Altitude, Speed, Heading, Distance**
    - **Weather**
    - **Vectoring by controllers for other reasons**

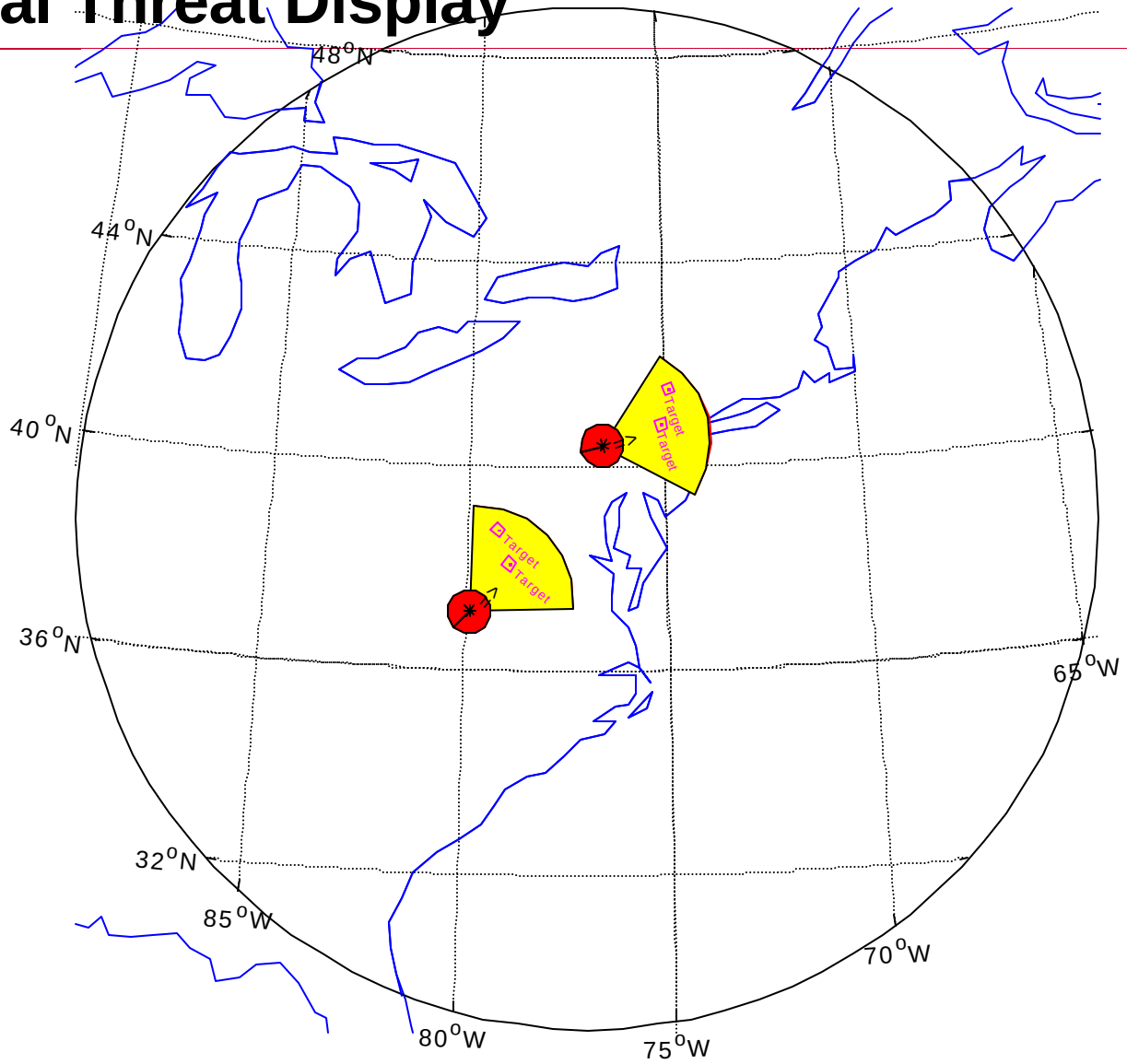
Draft System Requirements (cont'd)

- **Communication and Presentation of Anomaly Information**
  - **The System shall indicate to an operator deviant aircraft which present a high risk of being a rogue (I.e., a hi-jack)**
  - **The System shall allow an operator to indicate when an aircraft has been determined to be a rogue and communicate this to other operators**
- **Conflict Detection, Alerting and Resolution**
  - **The System shall allow operators to detect and resolve potential conflicts between a potential rogue and other aircraft**
  - **The System shall allow operators to detect potential conflicts between a potential rogue and high value ground targets**

New Surface Target Threat Display



Notional Threat Display



Threat Assessment

- **Rogue Aircraft Conflict Probe data to be available at all operational positions**
  - **Identification of all aircraft that may encounter the rogue, and recommended bearing to evade the rogue**
  - **The recommended bearing for any aircraft carrying national political figures, whether or not the aircraft will encounter the rogue**
  - **If multiple rogues, then provide optimum bearings for evasion**
  - **Prioritized outputs to ensure that the most time-critical evasions are initiated first**

Architecture - Phase 1 (lab demo)

- **Phase 1 deploys the Local Monitor Position stations**
  - **Pops up deviating A/C in list boxes.**
  - **Provides infrastructure for automatically generating FP amendments for threatened A/C**
- **Central Monitor Position at Security Command and Control Center (SC3) is simulated by**
  - **Consolidation of Deviating A/C lists from multiple centers.**
  - **Output of simulated Surface Target Threat Assessment data.**

Architecture - Phase 2

- McTMA system at SC3 would be attached to array of “remote” PGUI displays
  - Same as PGUI displays serving the Local Monitor Positions
  - “Remote” GUI’s fed by data server from each of the centers in “casino” array
- Additional displays attached to “extra” NAS Security functions at SC3
  - Output of Surface Target Threat Assessment application
  - Consolidation of A/C lists from multiple centers
  - Mosaic track displays containing all Rogue A/C
- Multiple McTMA strings at SC3 running in “shadow mode” for Centers of Interest.
- Demonstration of integration with advanced Wx visualization

Architecture - Phase 3

- **Addition of DSR Gateway Interface Module (DGIM) used to connect Local Monitors to sector controllers at DSR.**
- **Addition of duplicate suite of SC3 equipment at DoD**
- **Full messaging capabilities between DoD, Central, and Local Monitor positions**